

NOTOPLANA DUBIA (SCHMARDA) (PLATYHELMINTHES: POLYCLADIDA) FROM QUEENSLAND

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The intertidal polyclad *Notoplana dubia* (Schmarda) (Platyhelminthes) is reported for the first time from Australian coastal waters in Queensland. The significance of morphological differences observed between the Queensland specimens and the original descriptions are discussed as well as relationships with congeners in Australia and southeast Asia. □ *Polycladida, Acotylea, Notoplana dubia, new record.*

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Species of the polyclad genus *Notoplana* Laidlaw, 1903 occur commonly in the intertidal zone in southern Australia (Prudhoe, 1981, 1982). The commonest species, *N. australis* (Schmarda, 1859), has a wide distribution, ranging from South Australia to Sydney (Prudhoe, 1981, 1982) and occurs also in New Zealand. Of the remaining known species, *N. longiducta* Hyman, 1959 and *N. longisaccata* Hyman, 1959 have been described from the Sydney region, while *N. distincta* Prudhoe, 1982 and *N. longicrumena* Prudhoe, 1982 occur in South Australia (Hyman, 1959; Prudhoe, 1981, 1982). No species have been reported from northern Australian waters although several members of the genus occur in New Britain and southeast Asia (Prudhoe, 1985).

Faubel (1983) subdivided *Notoplana* based on the presence or absence of a penis stylet and transferred *N. longiducta* and *N. longisaccata* to a new genus, *Notoconiplana* Faubel, 1983, leaving *N. australis*, *N. distincta* and *N. longicrumena* in *Notoplana*. Prudhoe (1985) adopted a less formal approach, subdividing the genus into four groups to facilitate identification, the subdivision being based on the presence or absence of a penis stylet, penis papilla and penis sheath. Prudhoe's (1985) groups A and B correspond with Faubel's (1983) definition of *Notoplana*. Therefore, based on Faubel's (1983) definition, there are currently three species of *Notoplana* in southern Australia, all occurring south of the latitude of Sydney.

This paper reports the finding of a species of *Notoplana* from northeastern and southeastern Queensland and its identification as *N. dubia* (Schmarda, 1859), the type species of the genus.

METHODS

Polyclads were collected at low-tide from under rocks on exposed mud-flats. Mangroves (*Avicennia* spp.) were the dominant trees on the shorelines. Fixation followed the technique of Newman & Cannon (1995) in which polyclads were placed on filter paper in a dish of sea-water and when fully extended, the filter paper was rapidly placed on a block of frozen fixative, either 4% formaldehyde in sea-water or formaldehyde-calcium acetate-propylene glycol-propylene phenoxetol. Following fixation, worms were dehydrated in a graded series of ethanols, cleared in methyl salicylate and mounted in Canada balsam. One polyclad was stained in Mayer's haematoxylin prior to dehydrating and clearing. The median posterior sections of two polyclads were removed using a scalpel blade, embedded in paraffin and serial longitudinal sections, cut at a thickness of 7µm, were stained with Gill's haematoxylin and eosin. Drawings were made with a drawing tube attached to an Olympus BH microscope. All measurements are in millimetres and are presented as the range for 10 specimens.

All specimens collected have been deposited in the Queensland Museum (QM).

Specimens from Queensland were compared with the type specimens of *Centrostromum dubium* from the Naturhistorisches Museum, Vienna (NMV) and of *Notoplana evansi* Laidlaw, 1903, now a junior synonym, from the British Museum (Natural History) (BMNH). In addition other specimens in BMNH and the Swedish Museum of Natural History, Stockholm (SMNH) were examined and compared with those from Queensland.

POLYCLADIDA Lang, 1884

ACOTYLEA Lang, 1884

LEPTOPLANIDAE Stimpson, 1857

Notoplana dubia (Schmarda, 1859)

(Figs 1-6)

Centrostomum dubium Schmarda, 1859*Inioene truncata* Schmarda, 1859*Leptoplana dubia* Lang, 1884*Notoplana evansi* Laidlaw, 1903

MATERIAL. Four specimens, Port Denison, 5km S of Bowen, Qld, (20°2'S, 148°12'E) coll. I. Beveridge, 3.vii.1994 (QM G217332-5, serial sections G217343); 2 specimens, Scarborough, Moreton Bay, Qld, (27°12'S, 153°7'E) coll. T.H. Cribb, 15.v.1994 (G217336-7); 4 specimens, Wellington Point, Moreton Bay, Qld, (27°27'S, 153°14'E) coll. T.H. Cribb, 11.v.1994, 8.iii.1995, 1.ix.1997 (G217338-41, serial sections G217342).

DESCRIPTION. Large, oval polyclads; mature specimens 22-30 long, 13-16 wide; immature specimens 18-20 long, 9-11 wide; dorsal surface brown, darker in centre, ventral surface pale grey; nuchal tentacles diminutive, 3.9-5.6 from anterior margin; cerebral organ $0.54-0.57 \times 0.52-0.61$; eyes arranged in two elongate groups, on either side of mid-line, 45-55 anterior to cerebral organ, 15-18 posterior to cerebral organ; mouth 6.8-8.0 posterior to cerebral organ; ruffled pharynx in mid-body, with 10-16 lateral folds; male genital pore 2.8-3.9 posterior to mouth; antrum masculinum elongate, with folds; penis papilla elongate, prominent, with distinctive penis sheath; penis stylet prominent, 0.57-0.65 long, sclerotised, brown in colour; ejaculatory duct convoluted, leads to spherical prostate with epithelial tubes lying parallel to ejaculatory duct; seminal vesicle large, muscular, convoluted, passes dorsally then ventrally, terminating blindly; vasa deferentia enter seminal vesicle anterior to its extremity, coil posterolaterally then turn anteriorly to testes. Female genital opening 2.0-2.8 from male antrum, 4.6-6.5 from posterior end; vagina externa prominent with thick walls, leading to elongate, horizontal vagina media surrounded by masses of cement glands; vagina media passes anteriorly almost to level of male genital opening, terminating in blind diverticulum; diverticulum clearly visible in sections, not distinguishable in whole mounts; posterior to diverticulum, vagina interna passes dorsally either as sinuous tube, or, in less mature specimens in a coil, then leads posteriorly; uterine canals empty into vagina interna immediately anterior to termination of vagina in inconspicuous Lang's vesicle; no histological differentiation noted between vagina interna and Lang's vesicle;

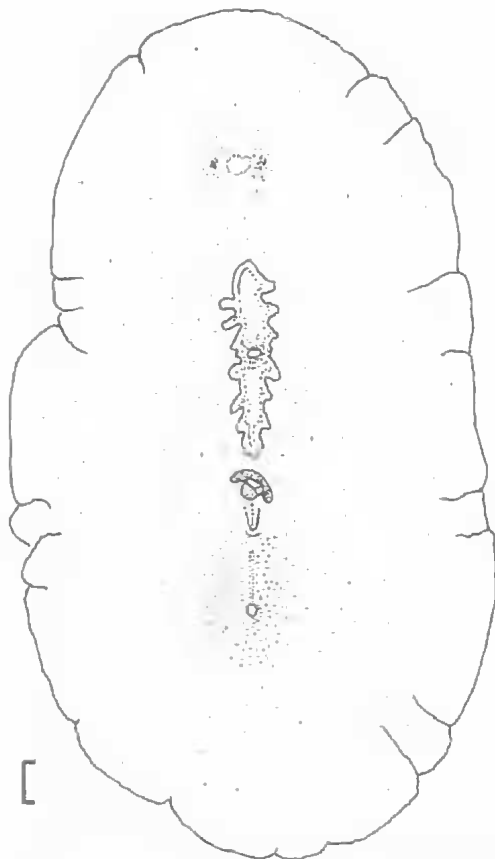


FIG. 1. *Notoplana dubia*, whole polyclad. Scale bar = 1mm.

uterine canals extend anteriorly on either side of pharynx.

DISCUSSION

The polyclad described above belongs to *Notoplana*, as defined by Faubel (1983), since it lacks a sucker, possesses cerebral and tentacular but not marginal eyes, an interpolated prostate subdivided into longitudinal chambers and a prominent penis stylet. The species belongs to Prudhoe's (1985) group A since it possesses both a penis stylet and a penis sheath. It most closely resembles the type species, *N. dubia*, in possessing a large, muscular, convoluted seminal vesicle, an elongate vagina media surrounded by cement glands and an extremely diminutive Lang's vesicle.

N. dubia has been described on a number of occasions. The original description by Schmarda (1859) is very brief but Stummer-Traunfels (1933) provided a comprehensive redescription

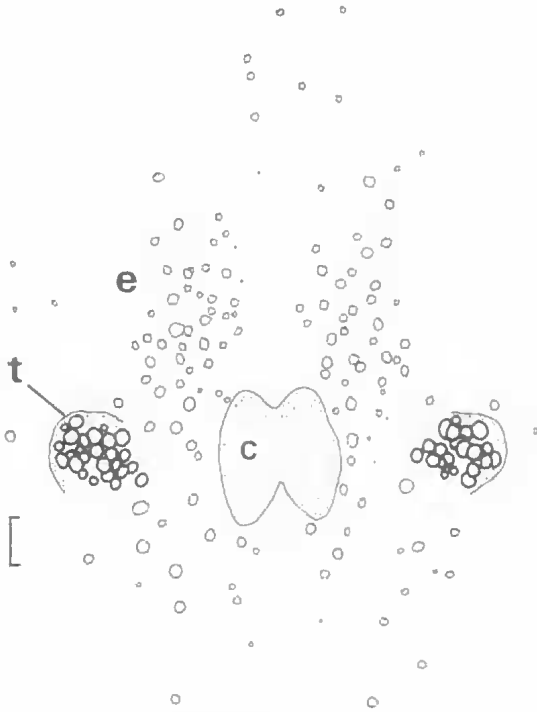


FIG. 2. *Notoplana dubia*, tentacles and cerebral organ. c = cerebral organ; e = eye; t = tentacle. Scale bar = 0.2mm.

based on the original specimens. The original description of Laidlaw's (1903) species, *N. evansi*, was poor, but the species was redescribed in some detail by Bock (1913), prior to the name being made a synonym of *N. dubia* by Stummer-Traunfels (1933). Hence, there is ample published data on the anatomy of *N. dubia*. The specimens described above from coastal Queensland agree in virtually all respects with published descriptions of the anatomy of *N. dubia*, with the exception of the diverticulum of the vagina media present in the Queensland specimens, which is not mentioned in any of the published descriptions. The type specimen in NMV was examined (NMV 13345) but consisted only of the anterior half of the specimen preserved in alcohol; the serial sections of the posterior region of the body were missing. The type of *N. evansi* (BMNH 1949.13.19.7) consists of the anterior part of the body mounted in balsam and nine slides of transverse serial sections. Because of the transverse orientation of the sections, the features of the vagina interna were not easy to distinguish, but there was no obvious indication of a diverticulum or of a coiled or sinuous ascending vagina. In the specimens of *N.*

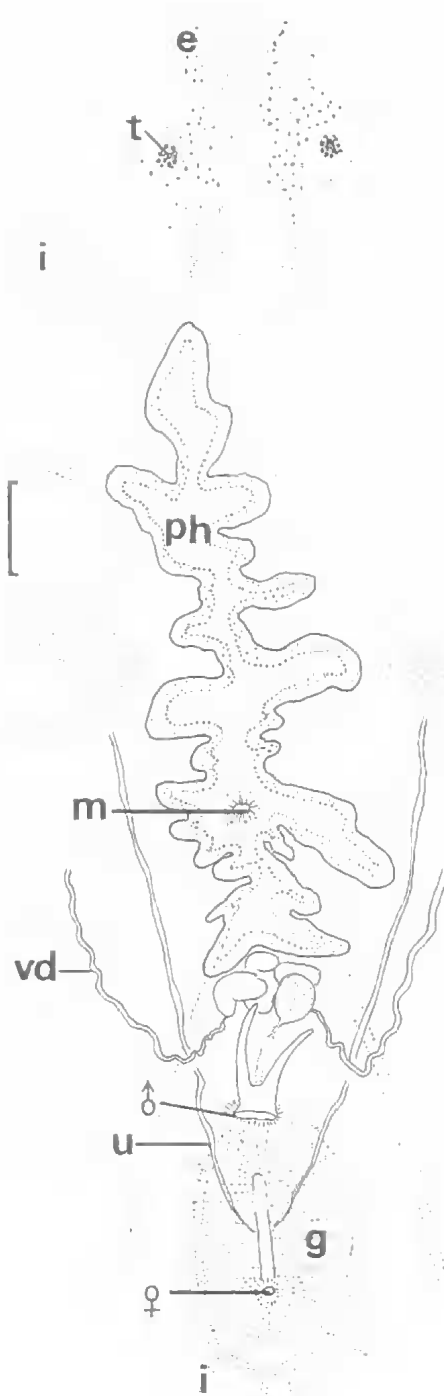


FIG. 3. *Notoplana dubia*, mouth and pharynx, showing positions of male and female genital openings. e = eye; g = cement glands; i = intestine; m = mouth; ph = pharynx; t = tentacle; u = uterine duct; vd = vas deferens. Scale bar = 0.5mm.

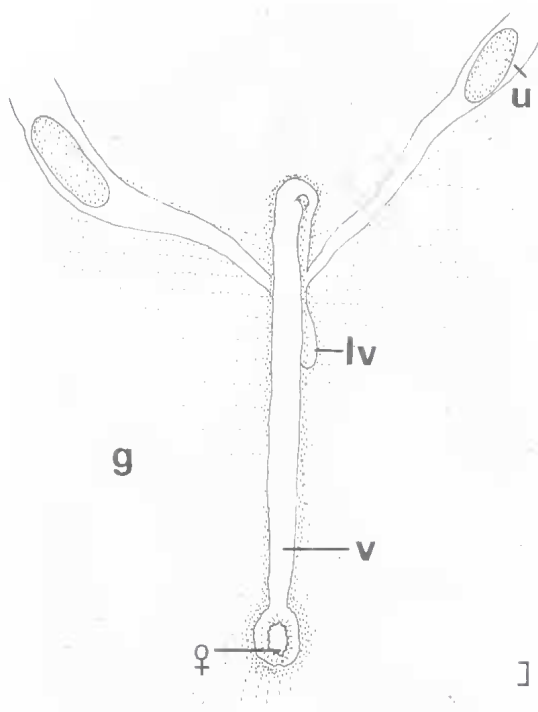


FIG. 4. *Notoplana dubia*, female genital system, ventral view. g = cement glands; lv = Lang's vesicle; u = uterine duct; v = vagina. Scale bar = 0.1mm.

dubia described by Prudhoe (1950) from Burma (BMNH 1950.10.24.8) however, the diverticulum of the vagina media, while not particularly elongate, was evident and the ascending part of the vagina interna was straight. Bock's (1913) material consists of one whole mount and 20 slides of serial sections. The vagina media was clearly visible only in one specimen and a diverticulum was detected. In this specimen, the vagina media was widely dilated with sperm while the diverticulum contained no sperm and had only a small lumen. The lack of prominence of the diverticulum may be the reason it was apparently overlooked by Bock (1913). Assuming that Bock's (1913) and Prudhoe's (1950) specimens are correctly identified, it appears that the vagina media of *N. dubia* has a prominent, anteriorly directed diverticulum. The specimens described above are identical with those of *N. dubia* identified by Bock (1913) and Prudhoe (1950). The form of the ascending region of the vagina interna appears to be variable and may be

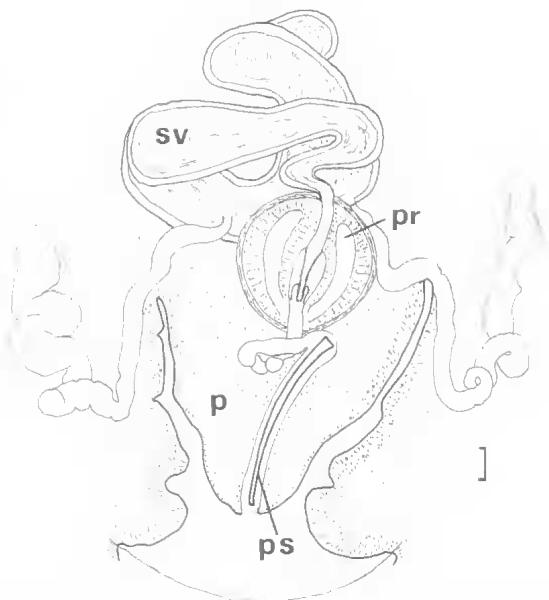


FIG. 5. *Notoplana dubia*, male genital system, ventral view. p = penis; pr = prostate; ps = penis stylet; sv = seminal vesicle. Scale bar = 0.1mm.

coiled in immature specimens with the coils extending into a sinuous or straight duct as the animal matures. The necessity of caution in interpreting coiled or folded structures in polyclads which may be subject to maturation and method of fixation has been emphasised by Prudhoe (1985) and Cannon & Grygier (1991).

In spite of these limitations, the current specimens have been identified as *N. dubia*. However, the possibility cannot be excluded that the current descriptions of *N. dubia* include two species, one with and one without an anterior diverticulum to the vagina media.

Other species of *Notoplana* recorded by Prudhoe (1985) from the Indo-West Pacific region were *N. willeyi* Jacobova, 1906 from New Britain, *N. mortenseni* Bock, 1913 and *N. parvula* Palombi, 1924 from Borneo and *N. tavoyensis* Prudhoe, 1950 from Burma. *N. mortenseni* was transferred to *Pleioplana* by Faubel (1983) and *N. tavoyensis* to *Notocomplana*.

N. willeyi was described from Blanche Bay, New Britain and is similar to *N. dubia* in many anatomical features, differing in being relatively narrower and in possessing a more obvious Lang's vesicle (Jacobova, 1906). Jacobova (1906) also distinguished *N. willeyi* from *N. dubia* (= *evansi*) based on colour, though there is no difference in colour between the two species

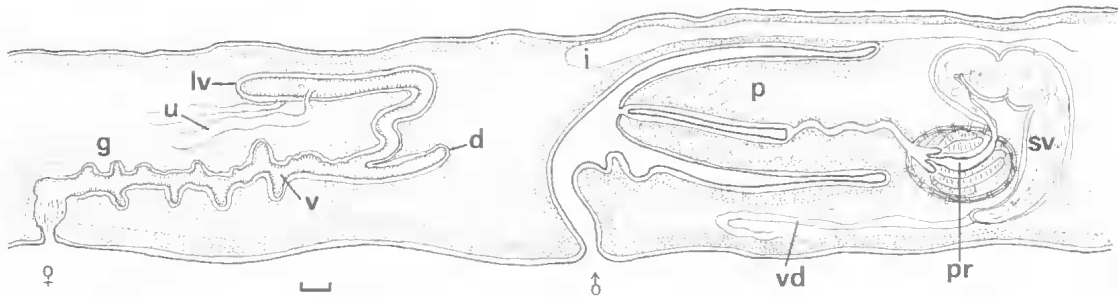


FIG. 6. *Notoplana dubia*, transverse section through genital openings. d = diverticulum; g = cement glands; lv = Lang's vesicle; p = penis; pr = prostate; sv = seminal vesicle; i = tentacle; u = uterine duct; v = vagina; vd = vas deferens. Scale bar = 0.1mm.

based on Willey's (1897) notes and those described above. She also distinguished the two species based on the position of the female genitalia, but the precise difference utilised were not specified (Jacubowa, 1906). Thus the differentiation of *N. willeyi* from *N. dubia* remains to be verified. Of particular interest in the description of *N. willeyi* is the illustration by Jacubowa (1906) (pl. 8, fig.8) of a small anterior diverticulum to the vagina media. Her sections were apparently slightly oblique making the significance of the diverticulum difficult to evaluate, but the structures illustrated warrant further investigation.

N. parvula is readily distinguishable from *N. dubia* since it possesses only a short vagina media and has far fewer cerebral eyes (Palombi, 1924, pl. 2, fig.15).

N. dubia is a widespread species occurring off the coasts of Burma, Malaysia and Sri Lanka (Bock, 1913; Stummer-Traunfels, 1933; Prudhoe, 1950). The present report extends this distribution to the east coast of Australia.

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